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Scope of Entomopathogenic Nematodes in Coconut Pest Management

Management of invasive whiteflies on coconut palms

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Articles, research papers and letters on different aspects of coconut cultivation and industry are invited for publication in this Journal. All accepted material will be paid for. The Board does not accept responsibility for views expressed by contributors in this Journal. All remittances and correspondence should be addressed to the Chairman, Coconut Development Board, Kochi - 682 011.

Coconut Development Board

The Coconut Development Board is a statutory body established by the Government of India for the integrated development of coconut cultivation and industry in the country. The Board which came into existence on 12th January, 1981, functions under the administrative control of the Ministry of Agriculture and Farmers Welfare, Government of India, with its headquarters at Kochi in Kerala State and Regional Offices at Bangalore, Chennai, Guwahati and Patna. There are five State Centres situated in the states of Orissa, West Bengal, Maharashtra and Andhra Pradesh and in the Union Territory of Andaman & Nicobar Islands. DSP Farms are located at Neriyamangalam (Kerala), Vegiwada (Andhra Pradesh), Kondagaon (Chhattisgarh), Madehpura (Bihar), Abhayapuri (Assam), Pitapalli (Orissa), Mandya (Karnataka), Palghar (Maharashtra), Dhali (Tamil Nadu), South Hichachara (Tripura) and Fulia (West Bengal) besides a Market Development cum Information Centre at Delhi. The Board has set up a Technology Development Centre at Vazhakulam near Aluva in Kerala.

Functions

❒ Adopting measures for the development of coconut industry. ❒ Recommending measures for improving marketing of coconut and its products. ❒ Imparting technical advice to those engaged in coconut cultivation and industry. ❒ Providing financial and other assistance for expansion of area under coconut. ❒ Encouraging adoption of modern technologies for processing of coconut and its products. ❒ Adopting measures to get incentive prices for coconut and its products. ❒ Recommending measures for regulating imports and exports of coconut and its products. ❒ Fixing grades, specifications and standards for coconut and its products. ❒ Financing suitable schemes to increase the production of coconut and to improve the quality and yield of coconut.

❒ Assisting, encouraging, promoting and financing agricultural, technological, industrial or economic research on coconut and its products. ❒ Financing suitable schemes where coconut is grown on large scale so as to increase the production of coconut and to improve its quality and yield and for this purpose evolving schemes for award of prizes or grant of incentives to growers of coconut and the manufacturers of its products and for providing marketing facilities for coconut and its products. ❒ Collecting statistics on production, processing and marketing of coconut and its products and publishing them. ❒ Undertaking publicity activities and publishing books and periodicals on coconut and its products.

The development programmes implemented by the Board under the project Integrated Development of Coconut Industry in India are- production and distribution of planting material, expansion of area under coconut, integrated farming for productivity improvement, technology demonstration, market promotion and Information and Information Technology. Under the Technology Mission on Coconut, the programmes implemented by the Board are development, demonstration and adoption of technologies for management of insect pest and disease affected coconut gardens, development and adoption of technologies for processing and product diversification and market research and promotion.

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Message from the Chairman's desk

Dear Readers,

The new financial year has started with new hopes and prospects for the different sectors of the economy. This is true in the case of agriculture too, especially for coconut which is a crop that is yielding throughout the year. The planting season of coconut starts from April- May in most of the areas receiving the south west monsoon rains, especially the west coast of the country and the north eastern states. Selection of the best quality planting material is of paramount importance so as to make the coconut gardens profitable, considering the perennial nature of the crop and long life span of 60-80 years. Hence production of quality planting material gains much importance at a time when agriculture has moved from subsistence farming to smart and sustainable agriculture.

With a view to ensure availability of quality planting materials and to demonstrate sustainable agriculture practices in coconut sector to the benefit of the stakeholder farmers, the Board has established eleven Demonstration cum Seed Production (DSP) Farms in major coconut growing states. The farms also maintain seed gardens with mother palms of elite varieties of coconut which are the source of seednuts for the production of quality seedlings.

Our great nation is now just few weeks away from the 75th Anniversary of Indian Independence. To commemorate the monumental occasion, the Board, alongwith various Departments / Ministries is participating in Azadi ka Amrut Mahotsav. Four National level events will be organised by the Board during this auspicious occasion. The first among them is the inauguration of "Centre of Excellence for Coconut" at Dhali, Tamil Nadu during the 3rd week of May. The Farm at Dhali is blessed with its congenial climatic and geo-physical environment and would be the first Centre of Excellence for Coconut in the country. The Centre would help to disseminate the latest available coconut technologies and would develop, store and disseminate knowledge gained and technologies derived in coconut sector so as to reach every stakeholder.

Let us work together and make the most of the forthcoming planting season of coconut to expand area in newer areas and rejuvenate the existing plantations so that the increased demand in the sector could be capitalized effectively to the benefit of the small holder coconut farmer and the future of the sector is also assured so that we do not run out of coconuts in the years to come.

Rajbir Singh IFS

Chairman

Management of invasive whiteflies on coconut palms in Andaman Islands

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Occurrence of whiteflies have become widespread in the recent years in most coconut growing areas of the country. The first report of invasive spiralling whitefly (*Aleurodicusdispersus Russell*) on coconut was reported during 1996. Report of rugose spiralling whitefly (*Aleurodicusrugioperculatus Martin*) was reported from major coconut growing states of Tamil Nadu and Kerala during 2016 which presumably got introduced through ornamental palms from Florida, USA has subsequently expanded to all coconut growing regions in the country including North-East (Assam). The serious incidence has now reached the remote Islands of Andaman and Nicobar Islands, affecting the coconut populations in South Andaman. The pest could have reached the islands from mainland India mainly through transported vegetables, fruits and ornamental planting material. As the pest was first noticed in and around Haddo, South Andaman, the main entry could be through the ships from mainland that brought in vegetables and fruits.

The spiralling whitefly, a sucking pest feeds from under surface of coconut leaflets and produce remarkably high quantity of honey dew, over which black coloured sooty mould deposits are grown on upper surface of leaflets. As the incidence of this pest is mainly restricted on older leaves, the economic crop loss has been postulated to be meagre as the damage is manifested in terms of slight reduction in photosynthesis. It is mostly reported as mild to moderate category since 2016 and is considered as a non-lethal pest triggered by favourable weather factors and non-adoption of palm health management strategies. However, the damage is more severe in the case of dwarf cultivars.

In 2018 and early 2019, two species of invasive nesting whiteflies viz., *Paraleyrodesbondari Peracchi* and *Paraleyrodesmineilaccarino* and a new invasive

coconut whitefly, *Aleurotrechulusatratus* have been reported on coconut from Mandya, Karnataka. The identity and biology have been established by ICAR-CPCRI and ICAR-NBAIR. Hence, till now, five invasive whiteflies mostly from neo-tropical New World region have been reported in the country. Competitive regulation of exotic whiteflies one on another has also been observed that suppresses the aggressive invasive potential of the pest in many coconut growing tracts of the country.

In Andaman, during December 2020, on hearing about the possible incidence of rugose spiralling whiteflies, from coconut growers and home gardeners, the team of scientists from ICAR-CIARI has conducted a survey in Haddo, Marine Hill and Sipighat areas of South Andaman and found occurrence of different species of whitefly population, infesting coconut. The infestation was mainly recorded in coconut particularly dwarf palms and on ornamental palm (Areca lutescens) in the surveyed areas. The different species seen are rugose spiralling whitefly, *Aleurodicusrugioperculatus*, (about 2.2 mm with brown mottlings on wing), spiralling whitefly, *Aleurodicusdispersus* (2.0 mm with no mottlings on wings), nesting whitefly, *Paraleyrodesminei* (1.1 mm triangular with no mottlings, adult resides on bird nest like colony, several of these colonies were seen infected by entomopathegenic fungus (*Aschersoniasp*.). The infested palms and all surrounding plants are heavily seen covered with sooty mould fungi, affecting the photosynthetic ability of the plants. The residents were complaining more about sooty mould rather than the whiteflies as the walls nearby, cars parked underneath the trees and all the potted plants were covered with flakes of sooty mould.

Subsequent field visits in coconut plantations revealed the incidence of rugose spiralling whitefly in several parts of South Andaman mostly on Andaman Yellow and Andaman Orange Dwarf palms whereas Andaman Ordinary Tall palms had lesser incidence. Moderate incidence was observed in Andaman Green Dwarf palms. Similar observations were noticed for nesting whitefly. In almost all the places surveyed, more than one species of whiteflies could be seen on the under surface of the palm leaflets in several colonies. At marine hill area, the colonies of rugose whiteflies and nesting whiteflies were also seen on surface of tender coconuts as well as leaf petioles besides the leaflets. At Chouldari, the nesting whiteflies were observed on crops viz., Noni, tapioca, banana, and ornamental plants viz, Hibiscus, Heliconia, crotons and palms. Among these, the occurrence of sooty mould was severe mainly in dwarf coconut palms. The nesting whiteflies were observed on the indigenous tree Andaman Padauk (*Pterocarpus dalbergioides*) also. While the colonies were seen on lower surface of leaves of all other host plants,the nesting whiteflies colonies were seen mostly on upper surface of Padauk.

Eco-friendly management practices are suggested to cope up with this pest as the Islands are free from use of chemical pesticides. The management strategies should start from seedling production stage. The immature stages and adult whiteflies in coconut seedlings in nursery need to be destructed before it is taken for distribution or sales. Domestic quarantine protocols to be observed and movement of whitefly infested coconut seedlings and other ornamental plants should be avoided. Installation of yellow sticky trap along borders of coconut nursery may help in entrapping the sooty mould deposit which would facilitate good growth of seedlings. Water spray by jet propulsion mode wherever feasible will help in dislodging whitefly colonies. As

Different species of whiteflies on alternate host plants in coconut environment of Andaman Islands

competition among the different species of whiteflies is reported to bring down the overall population, no pesticide approach must be followed which will help in conserving abundant natural enemies and bio-scavengers in the system. In severe cases, neem oil @0.5% spray on lower surface of palm leaflets can be followed to lower the pest population. Installation of yellow sticky traps on palm trunks and along field borders will greatly help. Besides, the palms should be maintained at good health with application of nutrients, organic recycling of residual biomass & irrigation wherever possible. Destruction of heavily infested older leaves would also help in bringing down the pest population.

Coconut, being a perennial crop with yield loss realized only after three years of pest infestation, a systematic methodology of yield loss assessment by rugose spiralling whitefly which is non-lethal and seasonal has not been evolved so far by the scientists.

As the susceptible cultivars such as Andaman Yellow Dwarf and Andaman Orange Dwarf palms are sporadically cultivated mostly in and around the households, the management would be easier. All species of these invasive whiteflies could be suppressed by this combined approach in these islands. However, the yield of palms is expected to come down for at least one or two years in the absence of proper management practices. Generally, any yield loss up to 10% on a non-fatal pest infesting coconut is considered insignificant because the intervention cost would not be compensated for yield recoupment.

In other coconut growing areas in the country, the infestation of rugose spiralling whitefly is reportedly prevalent mostly for a period of about four to five months during the summer period. Then the pest is naturally subdued from the infested palms during monsoon period and by competitive regulation of rugose spiralling whitefly population through co-existence of nesting whiteflies. Similar situation can be expected in Andaman Islands too. Hence, conservation biological control is considered as the successful strategy in the bio-suppression of invasive coconut whiteflies in the Island region.

As the islands enter the high rainfall season coupled with high humidity in the coming months, the pest population may naturally get reduced as whiteflies in general are reported as susceptible to wetness. Meanwhile, the work on identification of any natural enemies of this pest in coconut plantations of Andaman and Nicobar Islands need focus. The spread of this pest to other remote islands could be checked by domestic quarantine restrictions. By creation of awareness among the Islander communities about the possible damage by the pest and the management strategies to be adopted, the pest damage could be easily mitigated. ■

Tender Coconut Husk - various uses

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The coconut is an important fruit tree around the world, providing food, fuel and fibre for billions of people, especially in tropical and subtropical regions. As the palm has multiple uses it is aptly called the “the tree of life“. Coconut and its products are also known as a 'functional food,' since it provides health benefits over and beyond the basic nutrients. At any given time, a coconut palm bears 12 different types of nuts ranging from the stage of flower opening to ripened nut. Tender coconut (6-7 months maturity) water, the liquid endosperm inside the nut, is a wholesome and nutritious drink. It has an important role to play in the rapidly expanding functional foods market particularly nutraceuticals and pharmaceuticals.

The consumption of tender coconut water is prevalent in countries such as India. Accordingly, increase in the consumption of tender coconut water across various countries has led to expansion of market for coconut water during the last few years. Coconut water is the nutritious clear liquid inside the coconut fruit which is rich in vitamins and minerals. The amount of coconut water that can be harvested from each nut depends on the stage of maturity and the variety.

The increased consumption of tender coconut water has caused an increase in the generation of by products, such as the husk, which corresponds to approximately 60-65% of the fruit weight. The husks are generally discarded on embankments and left in the open environment as waste, where it takes eight to ten years to degrade (Corradini et al. 2009). Hence, consumption of tender nut water causes the generation and accumulation of bio-waste. As a result, contamination of the soil has become a problem. Moreover, husks are the breeding ground of

mosquitoes and other insects. Due to this, cities like Mumbai have banned the shops of tender coconut near hospitals. Therefore, there is a need for finding novel ways to use the husks from tender coconuts, particularly for value addition. This is because the fibers which is obtained from the mesocarp of coconuts, are cheap, recyclable, abundant and non-poisonous (*Satyanarayana et al. 2007*). Additionally, coir fiber is a versatile material, with applications in various engineering sectors, including the development of sustainable construction materials (*Ali, 2010*).

Tender coconut husk find multitude of applications. Some of the current uses of tender coconut husk includes- the fibre extracted from tender coconut husk is used in production of floor mats, door mats, brushes and mattresses, white coir harvested from unripe coconuts is used for making fine brushes, rope, and fishing nets. Young coconut husk can be converted into ash and used as partial cement replacement in masonry application, dried tender coconut husk can be used for production of bio char, activated carbon, etc.,. The texture of tender coconut husk is generally smooth and has a very high moisture content of about 80-85%. The rigidity of tender coconut is mainly attributed to its lignin content. Another major application of tender coconut husk is its conversion into convenient form of fuel for clean combustion.

The recent applications of tender coconut husk are highlighted in the present paper.

▶ *Fuel for clean combustion*

The tender coconut husk is in the soft form but it contains high moisture content with adequate fuel efficiency. Hence, processing the tender coconut husk could offer a valuable clean combustion fuel. The processed tender coconut fuel finds use in cooking. The methodology followed in the production of fuel from tender coconut husk involves the dewatering of the husk followed by drying and further processing to produce sustainable fuel which can be used as a fuel wood alternative. The shredded tender husk is used for fuel production and processing so that it could be used in domestic and community cooking applications.

▶ *Bio-oil production*

Because of its high volatile matter content, coconut husk can be used for the production of bio oil. The main biochemical components of husk include-lignin, cellulose and hemicellulose. Bio oil is a liquid which is produced by steam condensation process

from the pyrolysis process. The sub components such as lignin, hemicellulose and cellulose are oxidised to phenolic compounds as the main component of bio oil (*Fardhyanti and Damayanti, 2017*).

▶ *Second generation Bio ethanol*

By following the lignocellulosic ethanol production process, a fuel with the highest ethanol concentration per mass of initial substrate for the lowest price, less energy consumption could be made from tender coconut husk. The general processing steps adopted include –pre-treatment of coconut husk (alkaline, acid or other), hydrolysis (enzymatic/acid) and fermentation. The highest ethanol concentration was obtained using alkaline pre-treatment and acid hydrolysis (Maria bolivar- Telleria et al., 2018).

▶ *Handmade papers and garden articles*

Handmade papers and garden articles can be made from organosolv pulp (organosolv pulp involving hydrolysis and removal of lignin with an organic solvent). The pulp is usually diluted with water and poured uniformly over a screen. The wet pulp is then transferred to a cloth to remove excess water. As water drains, the fibres become closer, and after pressing and drying, calendaring of the handmade paper is done. The pulp can also be utilised in making paper plates, cups, glass covers, and garden articles such as paper pots for seedling and packaging by moulding into the desired shape and size.

▶ *Partial cement replacement in masonry application*

The discarded tender coconut husks with their shells were collected and burnt at about 600°C to produce ash that was mixed with fine aggregates and water as partial replacement of cement. Water-cement ratio of 0.485 and proportion of sand to cement is 1:2.75. The research findings stated that the suitability of using young coconut husk ash (YCHA) as cement replacement for concrete masonry application in the construction industry. The compressive strength obtained at 20% and 40% YCHA designed mixtures provide favourable conditions for masonry applications (Olan *et al., 2016)*.

▶ *Bio char production*

Bio char can be produced by the thermochemical degradation of biomass in a zero or limited oxygen environment through the process of pyrolysis. It is perhaps the most recalcitrant form of organic matter in soil, which sustenance extends from few hundreds to thousands of years, rendering it an excellent means for carbon sequestration. It improves the chemical properties of soil. Owing to the highly porous nature of bio char, soil application of bio char would ultimately lead to an enhancement of a wide range of soil physical, chemical and biological properties (*Atkinson et al., 2010*). The bio char production process involves sun drying of the coconut biomass residues until the moisture contents of the feed stocks reduce considerably. The dried feedstock was then layered into the kiln and heated at fluctuating temperatures of 350–450 °C range for 2–6 hr for producing the bio chars. The colour of the smoke was used as a visual indicator for the process of carbonization. No harvesting of the volatiles released during the process was adopted. Once the material was carbonized (turned black colour) through partial combustion, water was sprinkled over the hot bio char and allowed to cool. The cooled bio chars were then crushed to coarse particles and stored.

▶ *Production of activated carbon*

Activated carbon can be prepared from tender coconut husk by physicochemical activation method consisting of potassium hydroxide treatment and carbon dioxide gasification. The activated carbon preparation conditions were optimized by maximizing both the 2, 4, 6 trichlorophenol (TCP) uptake and the activated carbon yield (Tan, Ahmad, and Hameed, 2008). The production process is generally carried out in 3 stages namely- determination of lignin content, carbonization and activation step. The activated carbon thus obtained find use in several applications such as filtering of fruit juices, waste water treatment, etc., (Pattananandecha et al., 2019). Coconut-based activated carbon generally have the most micro porous pore structure, and possess the highest hardness compared to other types of activated carbon. Thus it is considered the best carbon for water filtration and it generates the least ash during production.

▶ *Mattresses*

Rubberized coir is a versatile product used largely as a less expensive substitute cushioning material for foam rubber in furniture, upholstery, and mattresses. Rubberized coir is made from curled fiber, which should be free from dust. The coir is made into endless fleece which is conveyed to the first set of rubber latex spray gums. Thickness of sheets is built by fixing multi layers fleeces and spraying is repeated to get a good bonding of layers. Then the sheet is hydraulically pressed and vulcanized to set the fibers. Rubberized Coir Mattress is made out of Rubberized Coir Sheets and Natural Latex Form Sheets. Rubberized Coir Mattress is gaining economic importance due to its high strength and durability among the market. The advantages of coir mattresses over the conventional are reliable, high strength, dimensionally accurate, and durable. The rubberized coir mattresses are widely accepted as bed for modern living style.

Conclusion

Tender coconut husk is accumulated as a bio waste in road side. The proper utilization of tender coconut husk will increase the income to coconut growers, street vendors and farmer's producer companies. However, there is no potential cost effective technology for proper utilization of husk. In this context, ICAR-CPCRI is working on the area of value addition of tender coconut husk.

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Coconut Sector in India at the crossroads: a brief narrative

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Introduction

Coconut is considered as one of the most important crops for the Asia and Pacific region, providing food, nutrition and livelihood to millions of coconut farmers in the region. Despite the economic importance of the coconut palm, coconut production continued to show stagnancy in production, productivity and trade in the recent decade (Sairam and Jayasekhar, 2019). The coconut sector in the past has been dominated by copra and coconut oil, and the international coconut trade used to be driven by the demand for coconut oil. However, demand for coconut oil has witnessed a sharp decline during the last decades due to increased competition from other edible oils, such as palm oil and soybean. Therefore, the price of coconut oil is influenced by the supply and demand of competing edible oils. In India, the coconut sector has been inextricably linked to the coconut oil, the most dominant product from the palm, from time immemorial. Such a strong dependency on a single product had indubitably made the sector vulnerable for supply and price shocks. It is also noteworthy that the issues of trade and market prices are increasingly playing a key role in sustaining the livelihood of those who are dependent on this sector. Hence, it is imperative to think beyond the periphery of production and productivity especially when a wide range of other issues plague the coconut sector (Harilal, 2010). The coconut sector in the country is internationally integrated and faces fierce competition from other major coconut producing countries especially in the post World Trade Agreement (WTA) and ASEAN treaty era. Despite the importance of coconut with respect to its economic, nutritive and health contributions, coconut farming in India has been lately considered as unremenurative. A robust and well strengthened value chain plays a key role in ensuring the sustainable livelihood of all the

Table 1. Percentage share of world exports of coconut products					
Sl. No	Product	Countries (percentage share)			
1.	Coconut oil	Philippines(47)	Indonesia(25)	Malaysia(5)	India(2)
2.	Copra meal	Philippines(58)	Indonesia(36)	Others(6)	India(--)
3.	Desiccated coconut	Philippines(27)	Indonesia(26)	Sri Lanka(8)	India(4)
4.	Coconut milk/cream	Indonesia(32)	Sri Lanka(53)	Philippines(9)	India(0.30)
5.	Coconut shell charcoal	Indonesia(78)	Sri Lanka(2)	Philippines(10)	India(10)
6.	Coir and coir products	Sri Lanka (39)	Philippines(17)	Indonesia (12)	India (32)
7.	Activated Carbon	Philippines(29)	Sri Lanka(16)	Indonesia(8)	India (35)
Source: Computed from ICC (2019)					

stakeholders' of the coconut sector. In this regard, it is crucial to assure the judicious distribution of revenue share along with the chain from producer to the consumer (Muralidharan et al., 2019).

Demand and supply scenario

The projected coconut demand for 2050 is predicted to be around 45000 million nuts. With the projected supply of around 36000 million nuts, there would be a demand-supply gap of 9000 million nuts by 2050. In order to meet the projected demand, the annual growth rate in production should be 3.20 per cent. As a matter of fact, coconut in future may experience a paradigm shift from the oilseed label, if promoted as food for nutrition, health care and environmental services to support the farming community. Moreover, the recent surge in the export of coconut products and the rising demand for tender coconut in the country are noteworthy. In such a scenario, by 2050, the demand for coconut would be certainly more than the estimated figure. Therefore, it would be a challenge to meet the futuristic coconut demand, especially because of the scarce land, labour, water and energy resources at disposal. An appreciable growth in total factor productivity and appropriate capital substitution are the possible alternatives and to achieve these, strengthening the traditional coconut based farming system through the use of modern research tools would be the starting point.

Table 2. Commodity trade matrix (exports): From India to other countries (export share in %)

Country	Coconut (Fresh)	Coconut (Dried)	Coconut (endocarp)	Oil (refined)	DC	Shell charcoal
UAE	55.5	1.4	9.9	50.2	18.2	1.8
ME (others)*	30.1		--	27.2	15.7	2.6
EU	6.8	4.7	--	--	8.6	38.9
Malaysia	--	43.7	--	--	--	--
Afghanistan	--	40.1	--	--	--	--
USA	--	2.1	36.3	2.4	10.0	1.5
Vietnam	--	--	17.2	5.2	5.3	--
Nepal	--	--	13.4	3.2	10.2	--
Canada	--	--	8.0	--	3.3	--
Singapore	--	--	4.9	--	--	--
Sri Lanka	--	--	--	--	--	43.5
Others	7.7	8.0	10.4	11.9	28.6	11.7
Total(Rs Lakh)	16059.2	11922.7	3202.5	14003.5	1176.7	3462.1

* Other Middle East countries
--Nil/Meager to be accounted
Sourced from Department of Commerce, Export Import Data Bank

Global competitiveness

It is imperative to have a look at the international trade scenario of coconut value added product exports. While comparing with other major global exporters, the share of India in coconut product exports is meagre (Table 1). Though it is an accepted fact that India holds a robust domestic market in the coconut sector, it is high time that India emerges as a major export player by upgrading its position in the global value chain of coconut exports. The Philippines and Indonesia together contribute the major world export share of coconut oil, copra meal and desiccated coconut. Sri Lanka too contributes substantially to the international exports of coconut milk, shell charcoal and coir products. However, in the case of exports of activated carbon, India is the leading exporter with a share of 35 per cent of the world exports. It is also noteworthy that, after the CDB was given the export promotion council status in the year 2009, the growth rate in exports of coconuts and coconut products from India had shown unprecedented surge due to the commendable efforts from the Board.

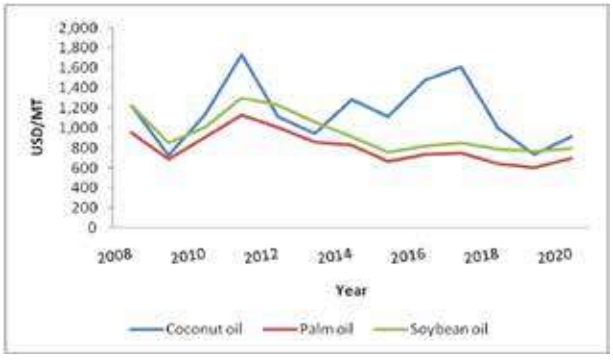

Fig 1. Price movements of major edible oils (2008-20)

Price analysis and comparison vis a' vis major edible oils

In the world-edible oil sector, the major players are soybean, palm oil, sunflower oil and rapeseed oil, wherein with comparatively lower production, coconut oil sector had to directly compete with these edible oils in the international trade facet. On the other hand, in the quality front, coconut oil stands as a premium product due to its high lauric acid content. Nevertheless, the international coconut oil prices are very much linked to the supply-demand equations of the other major edible oils and therefore subject to instability and price fluctuations. Palm kernel oil is the close substitute, and thereby the close competitor of coconut oil due to the lauric acid contents in both these oils. However, in the industrial front, oleochemical industry prefers palm kernel oil, whereas food and confectionery industries are more inclined towards coconut oil.

Adulteration of coconut oil with cheaper oils such as palm oil due to large price differential is a serious issue that affects coconut farmers and also human health. It is crucial that appropriate steps need to be taken to check adulteration and stop manufacturing, sale and distribution of adulterated coconut oil to protect the interests of both consumers and producers.

The price movements of coconut oil, soybean oil and palm oil for the period 2008-20 are depicted in Fig 1. It is striking that, excluding a few years, mostly coconut oil prices were much higher than the other two edible oils, and this price wedge was especially ruled at highest levels during 2013-18. The higher international prices than the substitutable edible oils will certainly debilitate the competitiveness of the coconut oil in the international market, and this is a matter of grave concern as far as the sustainability of the coconut sector in long term perspective.

The average percentage price difference of coconut oil in comparison with palm oil and soybean oil for the different period is illustrated in Table 3. The price difference with palm oil stood at 44.60 per cent for the period 2008-20 and in the price difference in comparison with soybean oil was computed to be 23.39 per cent.

While examining the price instability over the last 15 years, it was observed that in the initial five years (2006-10), the price instability indices of coconut oil (0.035), palm oil (0.040) and soybean oil (0.031), have not shown much difference. Still, in the subsequent period, coconut oil prices at the international level were comparatively volatile than the other two major edible oils. It is also noteworthy that the prices almost tend to yield stability in the cases of palm oil and soybean oil. In contrast, coconut oil has shown a tendency to increasing price instability.

Table 3. The average price difference (%) with coconut oil

Period	Palm oil %	Soybean oil %
2008-12	24.86	4.15
2012-16	21.12	2.01
2016-20	31.04	13.07
2008-20	44.60	23.39

Source: Author's calculation

Policy level impediments

For the past two decades, plantation sector in India has been confronting a commodity crisis, arguably, an off shoot of the ongoing trade liberalization. The regional trade agreements such as ASEAN-India Free Trade Agreement (AIFTA) has made the crisis even worse due to the adverse policy frame in the form of phased tariff reduction and fixation of import tariffs at extremely low-level. In this context, it would be erroneous to view coconut sector in isolation, because the trade and tariff decisions on competing crops as well as edible oils in general would straight away affect the coconut sector as well. In the tariff reduction schedule of the special products according to the AIFTA, the reduction commitment of palm oil (an immediate substitute of coconut oil) is notable. Unprecedented growth rate in palm oil imports in recent times is also a matter of concern in view of the domestic prices of the coconuts. The possibility of lowering the existing tariff structure of special products in the forthcoming review meetings of AIFTA is also bother some.

With the ongoing liberalization process across the world, proliferation of Regional Free Trade Agreements (RTAs) has become inevitable. There will be differential impact of such trade agreements on different sectors, and it is important to safeguard the plantation sector in general and coconut in particular in the forthcoming RTAs. In view of this, it is imperative to conduct studies on challenges faced by the coconut sector at micro and macro levels to bring out plausible strategic action plans for the sectoral reorientation. It is also crucial to envisage appropriate policy options with regard to the trade

and tariff structures of coconut sector and to ensure such sectoral details are appropriately represented in the national and international dialogues.

It is always better to have a floating import duty structure on edible oils, so that the tariffs can be adjusted in relation to the international prices of edible oils to stabilize the domestic price fluctuations. But in the case of palm oil in India, the import duty was always hovering around five per cent, irrespective of the international price movements. The flawed tariff fixation of such pattern had detrimentally affected the domestic price scenario (and movements) of the coconut oil in the country. Therefore, it is vital to regulate the edible oil tariff structure, so that the state machinery can adopt flexible policy options to control the price fluctuations of coconut oil.

Assessment of integration of MSP of copra with the price of coconut received by the farmers

The coconut market in India is always unstable and uncertain due to frequent fluctuations in prices. Usually fluctuation in price occurs due to change in market conditions aroused in response to seasonal and annual variation in production apart from competition from other edible oil particularly palm oil. Coconut prices in India have been historically integrated with the coconut oil prices. Therefore, indubitably the coconut prices received by the farmers are integrated with the MSP of copra. In general the farmer prefers to sell fresh coconut when the price of coconut is attractive, as he receives a remunerative sum in his hand immediately and he can get rid of processing and transportation charges. Contrary to this if the copra and oil prices are lucrative; farmer prefers to do at least primary level processing which would augment farm level copra production. Therefore, the MSP for copra fixed at higher levels would certainly influence and act as an incentive for the primary value addition in coconut. It should be in such a way that the MSP ensures an incentive for processing to the coconut farmers when compared with that of selling fresh coconut. Other pertinent factors in this context of discussion are lack of effectiveness and efficiency in copra procurement by the agencies and inadequate infrastructural facilities for the storage of copra.

Conclusion

The potential area of the coconut sector is the agri-business, based on value added products of coconuts. The breakthrough products developed from coconuts have the export potential and thereby in the long run, the price stabilization in the domestic coconut sector is also possible. In view of the proliferating regional trade agreements, hereafter the modalities of such a commodity specific trade agreement should be worked out with utmost care wherein we should end up in a win-win situation. In this respect we need to thoroughly analyze the existing tariff structure of each ICC countries, and an unbiased tariff reduction schedule should be proposed. It is also important to consider the existing tariff structures of close substitutes/competing products of each countries and there by arriving at a consensus.

Rerirement

Shri. K K Johnson retired from the services of Coconut Development Board on 31st March 2021 on super annuation. He has served the Board for around 33 years.

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Tank silt - an effective medium for enhancing coconut productivity

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Agriculture is the mainstay of the rural economy in Karnataka. Agriculture related activities support the livelihood and provide the largest share of total income to the people.Coconut is a major plantation crop in India for economic contribution and a livelihood source for millions of people. The crop is found throughout the world's tropic and subtropic areas and cultivated in around 80 countries. The crop is grown in 12.2 Million hectares of land worldwide, which constitutes about 0.7% of the world's net cropped area. Coconut palm provides food security and livelihood to large population globally, particularly in Asia Pacific Countries. India contributes about 15.46% in area and 26.3 % in terms of the production of coconut in the world. In India, coconut is cultivated in 1.97 million ha (2014-15) with a production of 20,439 million nuts with a productivity of 10,345 nuts per hectare and contributed about 15,000 crore rupees to the nation's GDP.About 12 million people of India are directly dependent on the coconut sector through cultivation, processing, and trading activities. The crop is mainly cultivated in the states of Kerala, Karnataka, Tamil Nadu and Andhra Pradesh. Among the states,Karnataka stands second in area (4.40 lakh hectares) and production (3,931 million nuts).

In Karnataka, Tumkur (32.76), Hassan (12.84), Chitradurga (11.48), Mandya (5.83), Chikkamagalur (5.22), Dakshin Kannada (4.81), Mysore (4.71), Ramnagar (4.71), Udupi (4.31) and Davangere (2.96)districts are contributing majority area of coconut cultivation. These top ten districts together contribute almost 85% among which Tumkur and Hassan districts contribute almost 45 %of the state's coconut production.

Coconut is a tropical crop and grows well in a hot climate. It adapts in almost all types of well-drained soils, such as alluvial, red sandy loam, coastal sandy, with slightly acidic to neutral in reaction. However, soil fertility and physical properties play a significant role in coconut production.The soil parameters like drainage, soil depth, nutrients and organic carbon status are the major factors for the growth and yield of coconut in Karnataka. Root penetration and development depend mainly on soil physical properties for water uptake and fruit quality and size.

The soils in the southern dry zone of Karnataka are red gravelly mixed shallow to very deep, well-drained soils with moderate to severe erosion. Due to excess sand and fine gravels,these soils are poor in water holding capacity, organic carbon and nutrient status. Hence,soil amendments like tank silt improve the soil physical property and enhance the productivity of coconut in these regions.

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Tank silt

Tank silt is a fine soil particle transported from catchment area by surface runoff and soil erosion during the monsoon period along with crop debris and deposited as sediment in the tank water spread area. The deposited soil and crop debris willdecompose over a period of time and become nutrient rich soil amendment. This silt is rich in organic matter with good physical properties. Nutrient flow in the undulated plains or watersheds; especially the leaching of soil nutrient along the water stream and accumulate in natural or manmade barriers such as tanks, ponds, ditches, lakes, and rivers well-documented phenomenon.

Many centuries ago, tanks were constructed to harvest the rain water to offset monsoons' vagaries for the irrigated agriculture.Agricultural lands form major part of the catchment areas and contribute to the tanks' rainwater storage. Intermittent and high intensity rainfall during the monsoon causes heavy surface runoff and erosion of valuable nutrient rich top soil from the surrounding agricultural lands. These soil particles along with nutrients are deposited as silt in the tanks.

Tanks serve as the most critical role of conserving the prime natural resources, like soil and water, which facilitate their multiple uses such as irrigation, flood control, groundwater recharge and other social, economic and ecosystem functions.However, the accumulation of silt in the tank adversely affect its storage capacity in the long run.

Benefits of tank silt

Application of tank silt to rainfed agricultural lands is an age-old traditional practice of South Indian farmers for filling eroded patches to sustain

land productivity. In Southern districts of Karnataka, till the recent past, it was very common that farmers maintain open compost pits in the farm and fill them alternatively with cattle yard waste and crop residues along with a layer of tank silt. The organic waste and tank silt will decompose due to alternate wetting due to rain and wind. After complete decomposition, this mixture is applied to agricultural lands before the onset of monsoon to replenish the soil nutrients, improve the soil texture and moisture retention capacity. Soil health is adversely affected by the continuous application of chemical fertilizers and the soil erosion process in dry lands. In this context renewed focus on the traditional wisdom of tank silt application and scaling up the practice will lead to better and sustained coconut production. Conservation and rehabilitation of traditional tanks by desilting is imperative for collecting and storing enough water for agriculture and the effective utilization of silt as a soil amendment in agricultural lands. The twin benefits of desiltation are augmenting water storage and improving the soil fertility of dry lands.

The efficiency of tank silt is its nutrient's potential

Improved soil physical properties

by hybridization of sandy and sandilome soils. Chemical properties indicated a decrease in soil pH and EC and increase in soil organic carbon, total and available N, P, available K and micronutrients. Higher average of crop yield and fruit quality was noticed in several part of Southern India.

Soil quality improvement through tank silt application

- Tank silt combination improves the water holding capacity of soils.
- Application of tank silt in combination with organic manure reduces the soil bulk density.
- Application of tank silt and FYM reduces the soil pH due to organic acid production during mineralization of organic materials.
- Enhancement of soil organic carbon content.
- Tank silt applied crop land is richer in soil available nitrogen, phosphorus and micro nutrients
- Application of tank silt in the soil helps retain nutrients in the soil and increases the nutrient availability to the crop.
- It is a good organic amendment for improving water-use efficiency and productivity.

Tank silt for coconut production

- Addition of tank silt to young and old coconut orchard reduce the soil erosion and increase the water infiltration rate.
- The high clay content of tank silt improves the drainage capacity of the red gravelly soils.
- Tank silt mixed with FYM, vermi compost and other

Improved the water infiltration

Enhanced yield

fertilizers ensure slow release of nutrients to the coconut.

• Tank silt, improves the soil bulk density, porosity and aeration which helps better root development of coconut tree in shallow soils.

• Improved soil texture and water holding capacity helps the coconut crop to withstand the water scarcity.

• Unavailable form phosphorus is converted to available form and easily taken up by the coconut roots.

• Clay- humus complex improve the micronutrients availability to the coconut plants and increase the nut production and quality.

• Good soil physical condition and increased biological activity improve the drought tolerances, fruiting capacity and size of coconuts.

Cost of tank silt

Cost of tank silt is only for transport, decided by distance of land from lake and flactuation of fuel prices. The quantity of tank silt load is decided based on the number of trees or area coverage. If there are 70 trees in an acre, they may promote 70 to 100 tractor loads of tank silt and approximately spend Rs. 10000 to 15000 for each occassion. After addition of tank silt to coconut orchard, leveling and strengthening of field bund is done, which may cost another Rs. 2000 to 3000 per acre. Thus the requirement is Rs. 15000 to 18000 for one acre. Once tank silt is incorporated to main field, farmers are cultivating fodder maize, fodder sorghum, ragi and banana as coconut inter crop which is expected to improve the soil qualities and farmers livelihood.

Conclusion

Tank silt is a locally available and low-cost substitute for costly soil amendments in dry zone of Karnataka. Application of tank silt is highly recommended due to its enormous benefits to the dry soils.Tank silt improve the soil texture, water holding capacity, soil organic carbon status and soil fertility in the coconut cultivated areas. Appropriate use of silt will improve the yield and quality of coconut and sustain the income of coconut farmers in the region. ■

IATF STARTS DISTRIBUTION OF VIRGIN COCONUT OIL TO HOSPITALS

The Inter-Agency Task Force for the Management of Emerging Infectious Diseases (IATF) has started distributing virgin coconut oil (VCO) to hospitals in the National Capital Region (NCR) to serve as an adjunct treatment for mild cases of Covid-19. Marco Reyes, president of VCO Philippines (Virgin Coconut Oil Producers and Traders Association of the Philippines) and vice-chairman of UCAP (United Coconut Association of the Philippines) has coordinated with IATF vice-chairman and Cabinet Secretary Carlo Nograles for the donation of VCO that will be distributed by the IATF to Level 1 hospitals in the NCR, the epicenter of Covid-19 pandemic in the country.

Reyes added that the VCO Philippines' move hopefully will be the start of the national government's strong push to promote VCO as a prophylaxis, if not an outright adjunctive cure for mild cases of Covid-19. "VCO must always be a part of every supplementation strategy for Covid-19. First, because it is completely safe. Second, because it is effective, at the least and, as of now, for mild symptoms as per DOST trials."

The DOST (Department of Science and Technology)-FNRI (Food and Nutrition Research Institute) had conducted a study which successfully showed that incorporating VCO in meals of suspected and probable Covid-19 cases in Santa Rosa City, Laguna helped in their recovery.

Meanwhile, DOST Secretary Fortunato dela Peña said the agency was still waiting for the results of the clinical trial on virgin coconut oil which it has funded. It is being done at the University of the Philippines-Philippine General Hospital (UP-PGH). "Our ongoing clinical trials for VCO for severe and moderate cases is picking up, there are more patients that have joined," dela Peña said in a recent weekly virtual Bayanihan report. He said there was a low percentage of patients that qualify to join the clinical trial because of the strict requirement for participants. "Only 28 patients passed the screening from 549 volunteers that agreed to join the clinical trial," dela Peña said.

Source: https://www.onenews.ph

Nematodes as an enemy and friend in coconut based cropping system

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Introduction

The term 'nematode' is derived from the Greek word 'nema-oides' which means "thread-like" and they are also known as thread worms. Nematodes are numerically the most abundant metazoans on earth and second only to insects, in terms of species diversity and abundance. They are observed to inhabit in all types of niches and majority of them are non parasitic which feeds on microorganisms. However, there are many groups of nematodes which parasitize plants, animals and human beings. Some even cause diseases to human beings.

Most of the plant parasitic nematodes are microscopic with a body length of less than one mm and majority of them are soil inhabiting which attack the root system. Nematodes need a thin film of water and make their way through pore spaces of the soil. Juveniles and adult males are always slender worms, where as adult females of some species like root-knot and cyst nematodes, expand their bodies and become nearly spherical.

In India, plant parasitic nematodes are estimated to cause crop loss worth Rs. 102 billion annually which is about 20.4% of the total loss due to pest and diseases together. Root knot nematodes alone are responsible for 75.8% of this total estimated loss. The losses due to nematode infestation were comparatively higher in horticultural crops (23.0%) than the field crops (18.2%).

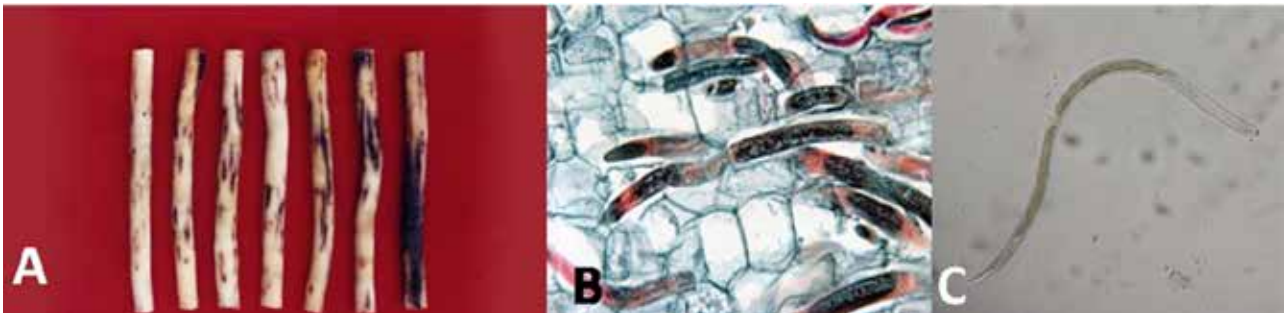


Fig 1: A- Burrowing nematode infestation in coconut root;
B- Burrowing nematode inside coconut root;
C- Adult female of burrowing nematode

Importance of plant parasitic nematodes in coconut ecosystem

The maximization of farm income from coconut based cropping system is possible only through judicious inclusion of various crops like vegetables, fruit crops, spices, tuber crops etc. in the interspaces of coconut garden. The incidence of various biotic stresses like pests and diseases are the major limiting factor in this system. Among them, plant parasitic nematodes are observed to be a major threat to most of the intercrops in the coconut system. This is serious especially in the coastal sandy belts, where the nematodes are abundantly prevalent.

Many are unaware about the relevance of nematodes as they are microscopic, not visible to the naked eye and produce non specific above ground symptoms in the affected plants. Therefore, the crop losses due to plant parasitic nematode infestations are mostly misinterpreted as due to other pests or diseases. It is a silent killer of plant health and affects yield considerably in a concealed manner.

Root infestation of plant parasitic nematodes severely affect the water and nutrient uptake of the plants, which lead to crop loss. As they are obligate parasites and the survival of the host plant is essential for their own existence, plant parasitic nematodes rarely kill their host plant but severely affect the quality and quantity of the economic produce.

Burrowing nematodes (Radopholus similis), Root knot nematodes (Meloidogyne spp.) and lesions nematodes (Pratylenchus spp.) are the most important plant parasitic nematodes which are widely distributed in the coconut based cropping system. Both burrowing and lesion nematodes are migratory endoparasites, which feeds by making burrows in the roots, which lead to the development of lesions and severe rotting of the root system. Root knot nematodes are sedentary endoparasites, which forms galls in the roots or underground root or stem tubers.

Burrowing nematode (*Radopholus similis*)

The burrowing nematode occurs in tropical and subtropical areas of the world and has been reported from coconut palms in Florida, Jamaica, Sri Lanka and India. The burrowing nematode causes non-specific general decline symptoms such as stunting, yellowing, reduction in number and size of leaves and leaflets, delay in flowering, button shedding and reduced yield. They are migratory endoparasites, develop and reproduces inside the roots of coconut seedlings. Their infestation produces small, elongate, orange-colored lesions on tender creamy-white roots. Consequent to nematode parasitization and multiplication, these lesions enlarge and coalesce to cause extensive rotting of the roots. Their impact will be more severe on the seedlings as the infected roots impairs the nutrient uptake potential and leads to production of weaker seedlings in nursery.

Burrowing nematodes also infest intercrops like black pepper, banana, betelvine, ginger, turmeric etc. Burrowing nematode is the causative agent of the slow decline disease of black pepper. The disease is initially manifested as the appearance of few pale yellow drooping leaves. Gradually the number of such leaves increases and within a year or two, the entire foliage becomes yellow which is followed by leaf shedding and appearance of dieback symptoms.

The burrowing nematode infestation in ginger and turmeric result in stunted growth, reduction in vigor, reduced tillering, early drying and maturity. The topmost leaves become chlorotic with scorched tips. Infested turmeric rhizomes tend to lose their

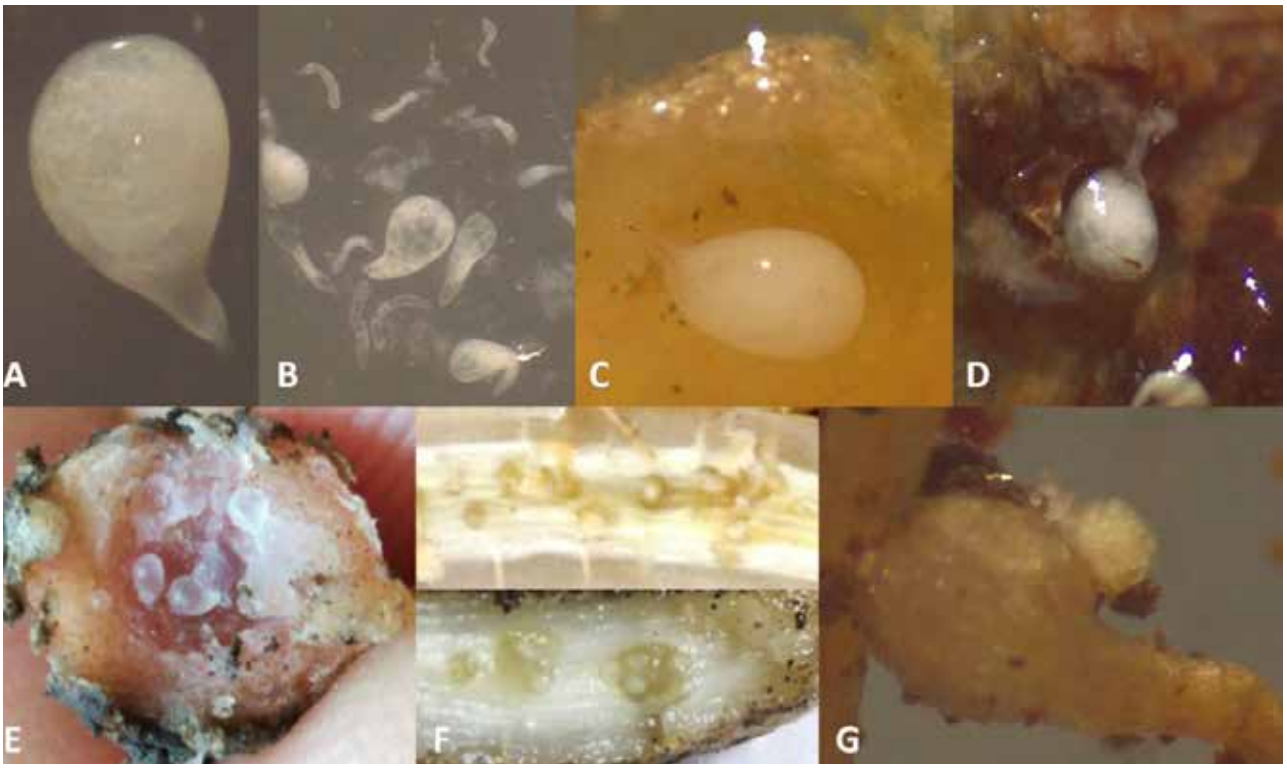


Fig 2: A- Adult female of RKN; B- Develpmental stages of RKN; C- Adult female inside turmeric root; D- Adult female inside guava root; E- Adult females inside amorphophallus; F- Adult females and egg masses inside ginger root; G- Gall with egg mass on the feeder root of papaya.

Fig 3: Symptoms of Root knot nematode infestation. A- Turmeric; B- Ginger; C- Carrot; D- Alternanthera (weed).

characteristic bright yellow colour and show brown rotting.

The burrowing nematode infestation result in the toppling disease in banana. The nematode induces reddish brown cortical lesions on the roots and corms. The root and rhizome necrosis is manifested as stunted growth, yellowing and falling of mature plants.

Root knot nematode (Meloidogyne spp.)

Root knot nematodes (RKN) are the most economically important plant parasitic nematode with a broad host range including weeds. They are obligate endoparasites with sedentary nature causing severe economic damage to a wide range of crops.

Their damage is observed to be very severe in almost all intercrops of coconut especially in the light textured soils. The infested roots become distorted and develop rounded or irregular galls, which are manifested as severe stunting and yellowing of the foliage. During many occassions times these galls coalesce together and cause extensive distortion of the roots or the affected tubers. The RKN infestation also aggravates the effect of many pathogenic bacteria and fungi.

Root knot nematode infested ginger and turmeric show stunting, chlorosis and marginal necrosis of leaves. Roots exhibit galling as well as bulging, which leads to the rotting of the roots and rhizomes. When the infested roots split open, presence of many adult females, egg masses with hundreds of eggs will be seen.

In vegetables and fruit crops RKN induce characteristic galls with varying sizes in the root system. In amorphophallus, RKN attack the corms where they develop rounded galls on the entire

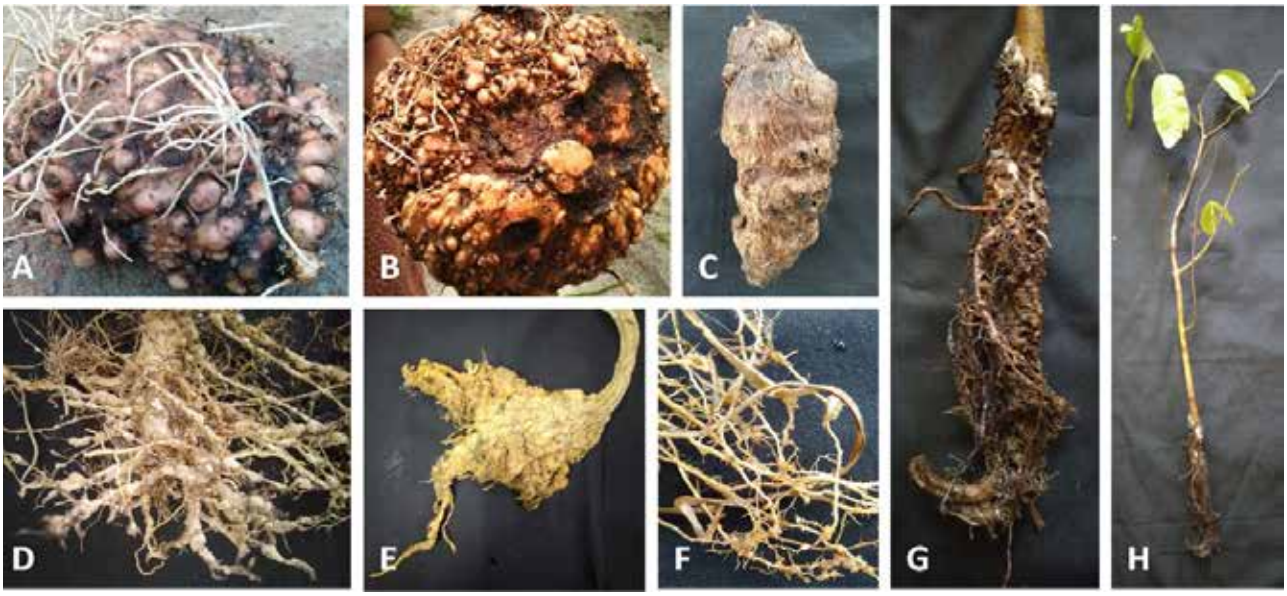


Fig 4: A & B- Root knot nematode infestation in amorphophallus; C- RKN infestation in colocasia; D- RKN infestation in okra; E- RKN infestation in bitter gourd; F- RKN infestation in little millet; G & H- RKN infestation in guava.

surface of the corm. The presence of many adult females along with different developmental stages of the nematode and egg masses in every galls is a characteristic feature.

Spread of Plant parasitic nematodes

Plant parasitic nematodes are able to move to very few distances as their own and the active dispersal is limited to few centimeters. Therefore the long distance spread takes place passively by the wrong cultivation practices like use of infested seeds, seedlings, rhizomes and rooted cuttings of different plants. They are also spread through soil particles adhering to agricultural tools and implements and through the irrigation water.

Diagnosis

The above ground symptoms induced by the infestation of plant parasitic nematodes are confused with the symptoms caused by other soil pathogens or as nutrient deficiencies. Therefore, when a farmer encounters plants that are stunted, chlorotic or yielding poorly, he may take soil and root samples and send to an approved nematology laboratory. The soil samples should be moist and collected from the root zone of the crop, where active roots are present. Collect several samples from the suspected plants and mixed together and take a 200 g representative sample, put in a polythene bag, tie it, label properly, keep away from the direct sun light and send immediately to the approved nematology laboratory. The infestation of nematode at the farmer level can also be confirmed by the characteristic symptoms on the roots or tubers as shown in the figures 1, 3 and 4.

Management

Coconut

1. Care must be taken to ensure the seedlings are free from nematode infestation at the time of transplanting. Remove old roots of coconut seedlings showing the characteristic symptoms of burrowing nematode infestation.

2. Avoid planting of preferable hosts like banana or black pepper near the coconut nursery. Planting of marigold along the borders and interspaces can act as antagonistic crop and reduce the nematode population.

3. Application of neem cake @ 1 kg / sq. m. area of nursery bed at the time of preparation of coconut nursery bed is effective for nematode management.

4. In order to avoid the buildup of the nematode population it is advisable to change the nursery site every year.

Intercrops

1. Use planting materials free from nematode infestation. Care must be taken to remove any roots

Fig 5: A- Cadaver of greater wax moth larva killed by Heterorhabditis sp.; B– Infective juveniles of EPN; C- Cadaver of greater wax moth larva killed by Steinernema sp.; D- Cadaver of red palm weevil grub killed by Steinernema sp.

showing the characteristic symptoms of nematode infestation and soil particles adhering to the planting materials.

2. Infested roots harbor thousands of egg masses of the nematode, which can lead to the huge economic loss to the subsequent crop. Therefore, it is very crucial to remove and destroy all the plant debris including the entire root system after each harvest.

3. Deep summer ploughing once in two weeks followed by fallowing will help in exposure of nematodes hiding in the deep soil layers to scorching sun light and considerable reduction in the population.

4. Soil solarization is the passive heating of moist soil covered with a plastic mulch. Soil solarization during the hottest part of the year by using transparent plastic mulch over the moist soil for a period of three weeks will result in the destruction of nematodes.

5. Growing cowpea and soil incorporation after 30 to 40 days will act as a trap crop for root knot nematode besides improving the fertility status of the soil.

6. Application of green leaf manures and organic amendments to improve organic status of the soil and thereby improving the soil antagonistic activity.

7. Liming, application of recommended dose of fertilizers, adoption of proper drainage and irrigation facilities will induce plants to tolerate nematode infestation to greater extent.

8. Crop rotation by including different types of crops in order to avoid population build up of the nematode. Growing antagonistic crops like marigold in the borders and interspaces will help in reduction of nematode population.

9. Soil application of biocontrol agents like Trichoderma, Pochonia, Paecilomyces etc. enriched in the neem cake and vermicompost or dried farmyard manure is effective for the management of plant parasitic nematodes.

Nematode as a friend: Nematodes for the management of insect pests of coconut

Entomopathogenic nematodes (EPN) belonging to families *Steinernematidae* and *Heterorhabditidae* are soil inhabiting insect pathogens. These nematodes, working with their symbiotic bacteria (*Xenorhabdus* for *steinernematids* and *Photorhabdus* for *heterorhabditids*), kill insects within 24 to 48 hours. They are safe for the plant health, human health, soil and the environment. There is a huge potential for the utilization of these biological control agents for the management of many coconut pests like white grub, rhinoceros beetle, red palm weevil etc.

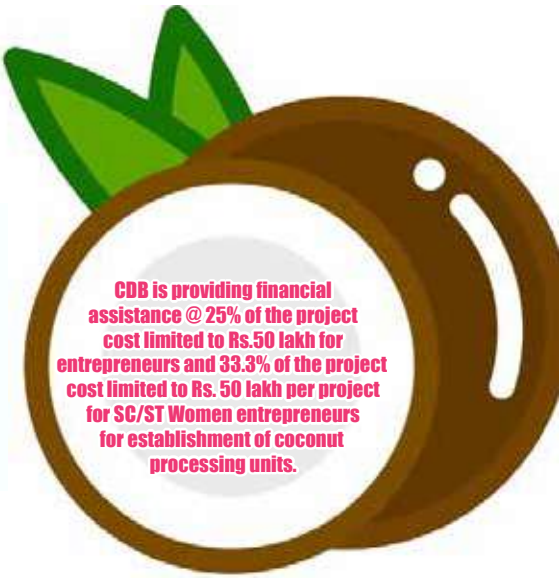
Use of EPN in coconut pest management is gaining importance due to environmental safety and associated long term pest suppression. Different formulations such as EPN in suspension, cadaver etc. are being attempted for pest suppression.

Conclusion

Nematodes are ubiquitous and present everywhere and majority of them are free living but many are parasitic or pathogenic. Plant parasitic nematodes are widespread in the coconut ecosystem and symptoms are visible only when the population exceeds a particular level. Even at very low population levels, their feeding invites many pathogenic fungi and bacteria and the host plant/crop become susceptible to many diseases. By careful adoption of management practices the population build up of nematodes can be checked and there by protect the crop from the nematodes as well as from other pests and diseases to a greater extent. Entomopathogenic nematodes are promising biocontrol agents which possess great potential to be used against insect pests of coconut and its intercrops. ■

Value Added Products from coconut

Being a zero wastage product, the product basket from coconut is enormous. Some of the value added products from coconut are Desiccated Coconut (DC), Virgin Coconut oil, Coconut chips, Coconut milk, Coconut milk powder, Coconut Vinegar, Coconut oil, Tender Coconut water, Ball copra, Neera and Neera products, Coconut ice cream, Coconut body lotion and so on. As part of the product promotion, commercial production units have been started in various parts of the country under Technology Mission on Coconut (TMoC).



COCONUT INFLORESCENCE Based Food Products

Neera

The vascular sap collected from immature unopened coconut inflorescence is popularly known as Neera in fresh form. It is a sugar containing juice and is a delicious health drink and a rich source of sugars, minerals and vitamins. It is sweet and oyster white in colour and translucent. It is tapped from the coconut inflorescence and is filtered, pasteurized and bio preservatives are added to preserve the product. Treated Neera can be preserved in cans upto two months at room temperature. It can also be packed in tetra packs or glass bottles. Tapping can be done for six months in a year. It is an abundant source of minerals, 17 amino acids, vitamin C, broad spectrum B vitamins and has a nearly neutral pH.

Composition of Neera			
Sl. No	Parameters	Raw Neera	Packed Neera
1	pH	6.2	5.2
2	Brix/TSS	15.13%	15.37%
3	Total sugar	15.00 %	15.00 %
4	Total mineral matter	0.27 %	0.26 %
5	Protein	0.106 %	0.106 %
6	Fat	traces	nil

Installed Capacity - 5000 litres/day

IRR - 28%

Investment - Rs. 2.5 crore

Incentive: 25% of the project cost or a maximum of Rs. 50 lakhs

Coconut Jaggery

Coconut jaggery is prepared by boiling fresh neera to 118-120° C and allowed to cool for solidification. The solid mass is known as coconut jaggery or 'gur'. Coconut jaggery is made in traditional coconut growing tracts in the country on a cottage scale. Calcium and phosphorus are the important minerals contained in coconut jaggery. Treacle is another product manufactured from sweet toddy. It is obtained by boiling down the toddy. Fresh toddy is also a good source of baker's yeast. The fresh neera rapidly ferments and the sugar is replaced by about 5-8 per cent alcohol, which on distillation yields arrack. Fermented neera on acetic fermentation yields vinegar containing 4-7% acetic acid.

Nutritional value of jaggery		
Sl No	Parameters	Amount (%)
1	Moisture	9.1
2	Carbohydrate	87.54
3	Protein	0.72
4	Minerals	1.97
5	Fibre	0.46

Installed Capacity - 200 Kg/day **Investment - Rs. 15 lakhs**

IRR - 18% **Incentive: 25% of the project cost or a maximum of Rs. 50 lakhs**

Coconut Palm Sugar

The coconut palm syrup or jaggery can be crystallized to produce fine granules of sugar. Transition of coconut jaggery into a ground granule sweetener is more accepted by global markets. The recovery of palm sugar from coconut palm jaggery is 15%. The application of this sugar is tremendous and offers huge potential owing to its most important health attributes, the low Glycemic index and the high nutrient content. It can be the most suited alternative sweetener, especially when agave sugar is being rejected owing to the high fructose content. This alternative sugar industry is estimated to be a $1.3 billion industry and hence the market prospects are enormous.

Coconut Flower Syrup

This is a product similar to jaggery with high mineral content and is a rich source of potassium. It has good content of sodium and is free from total fats and cholesterol. It is produced when fresh Neera is heated and concentrated into syrup. The input output ratio is 6:1. The syrup has 50% sucrose content and possess low glycemic index at the levels of 35 GI which indicates that low levels of sugar gets absorbed into the blood thus making it safe for diabetic patients.

Nutritional Value of Syrup		
Sl No	Parameters	Amount (%)
1	Total Soluble Solids	81.44
2	Carbohydrate	65.43
3	Protein	0.39
4	Minerals	2.00
5	Acidity	0.04

Installed Capacity - 200 litres/day

Investment - Rs. 15 lakhs

Incentive: 25% of the project cost or a maximum of Rs. 50 lakhs

IRR - 18%

Coconut Convenience Food Products

Coconut Biscuit

Coconut biscuits are ready to eat snack products prepared from maida and coconut powder. It can be prepared in different varieties through addition of cocoa, butter; ginger etc. The product has a shelf life of three months under ambient conditions. It is mainly consumed as a snack item. Coconut biscuits are highly nutritious and delicious with low calories and high fiber content and is one of the healthiest snack items which is quite popular and is in great demand in Asia and Pacific countries, USA, European countries, Middle East and African countries.

Coconut Candy

Coconut candy is prepared from grated coconut mixed with coconut milk. It has high fiber content and helps prevent intestinal sluggishness. It is a newly introduced product mainly produced in Asia and Pacific Countries.

Coconut Chocolate

It is a sweet confectionery item prepared from coconut gratings sugar, milk butter with a coating of chocolate. It is rich in protein, carbohydrate and fiber. It can be made more delicious through addition of cashew, badam and other dry fruits. The product has a shelf life of three months under refrigerated conditions. The product is having extensive demand in Europe, North America, Australia, Middle East and China.

Coconut burfi

It is a snack prepared by roasting coconut gratings. A procedure for preparation of coconut burfi was standardized. Coconut gratings (after extraction of fat) is roasted, followed by addition of fat at the rate of three percent and sugar at ten percent. The product has a good nutritive value with protein (10.23%), Ash (2.1%) and carbohydrates (60.87%).

Coconut Shell Based Products

Coconut Shell Charcoal

Shell Charcoal is obtained by burning the shell of fully matured coconuts with a limited supply of air so that they do not burn away to ash but are only carbonized. The manufacture of shell charcoal shows from the coconut shell has become a very important economic and commercial activity. Furthermore, coconut shell charcoal, which was relatively a minor product in the past, has now developed into a general commercial commodity due to its intrinsic value as a raw material for the manufacture of activated carbon. Coconut shell charcoal are of two types: viz Coconut shell charcoal and granulated shell charcoal.

The quality standards for shell charcoal as per Asian and Pacific Coconut Community (APCC) are as follows:	
Moisture	Less than 10%
Ash	Not more than 2%
Volatile matter	Not more than 15%
Fixed carbon	Not more than 75%
Foreign matter	Not more than 0.5%
Colour	Black
Size	Not more than 5%, shall pass a 0.63 cm mesh sieve.

Type I – Coconut shell charcoal – pieces

Type II – Coconut shell charcoal - granulated

Installed Capacity - 3 tonnes/day

Investment - Rs. 70 lakhs

IRR - 22%

Incentive: 25% of the project cost or a maximum of Rs. 50 lakhs

Coconut Shell Powder

Coconut shells free from contamination of coir pith, etc., are broken into small pieces and fed into a pulveriser. The powder from the pulveriser is fed into a cyclone and the parallel product is collected in bag filters. The shell powder is then fed into a vibrating sieving machine and packed according to mesh size requirements for various end uses. The rejects from the sieving machine can be recycled in the pulverizer for size reduction. The main requirements for consistent good quality of coconut shell powder are proper selection of shell of proper stage of maturity and efficient machinery.

Product Specification	
Appearance	Clear light brown free flowing powder
Moisture	10 per cent max.
Apparent density	0.6 to 0.7 g/cc
Ash content	1.5 max.
Sieve analysis	Retained on 200 mesh BS sieve shall not exceed 0.1%

Installed Capacity - 3 tonnes/day

Investment - Rs. 75 lakhs

IRR - 18%

Incentive: 25% of the project cost or a maximum of Rs. 50 lakhs

Activated Carbon

The process of activation is carried out in two stages. Firstly the coconut shell is converted into shell charcoal by carbonization process which is usually carried out in mud-pits, brick kilns and metallic portable kilns. The coconut shell charcoal is activated by reaction with steam at a temperature of 900°C -1100°C under controlled atmosphere in a rotary kiln. The reaction between steam and charcoal takes place at the internal surface area, creating more sites for adsorption. The temperature factor, in the process of activation is very important. Below 900°C the reaction becomes too slow and is very uneconomical. Above 1100°C, the reaction becomes diffusion controlled and therefore takes place on the outer surface of the charcoal resulting in loss of charcoal.

Products Specifications	
PH Value	6.5 - 7.5
Methylene Value adsorption mgm/gm	190 - 350
Adsorption capacity at % by mass (min)	45
Moisture (max.)	5%
Ash (max)	5%
Hardness	90

Installed Capacity - 6 tonnes/day

Investment - Rs. 5.5 crore

IRR - 28%

Incentive: 25% of the project cost or a maximum of Rs. 50 lakhs

Scope of Entomopathogenic Nematodes in Coconut Pest management

Rajkumar and Sujithra M

ICAR - Central Plantation Crops Research Institute (CPCRI), Kasaragod – 671 124, Kerala.

Entomopathogenic nematodes (EPNs) in the genera *Steinernema* and *Heterorhabditis* are proven bio - control agents and are widely used to control economically important insect pests of various crops across the world. They are associated with mutualistic bacteria genus *Xenorhabdus* in case of *Steinernematidae* and *Photorhabdus* in Heterorhabditidae, respectively. Infective juveniles (IJs), the only free-living stage of EPN (Fig1 a & b) enters insect hosts through natural openings (mouth, anus, and spiracles), or in some cases, through the cuticle. After entering the host's haemocoel, nematodes release their bacterial symbionts, which are primarily responsible for killing the host usually within 24 to 48 hr, defending against secondary invaders and thereby creating the environment for nematodes multiplication. EPNs have numerous attractive attributes such as durable infective stage, amenable to ease mass multiplication under laboratory conditions; host-seeking ability, safe to mammals and other non target organisms, and are exempted from registration in many countries. Moreover, EPNs can be stored for 9 - 12 months, which aids in the marketing of nematode-based products.

Mass multiplication of EPN on host insect, Galleria mellonella

Larvae of greater wax moth, *Galleria mellonella* can be used for mass multiplication of entomopathogenic nematodes (EPNs) of steinernematid and

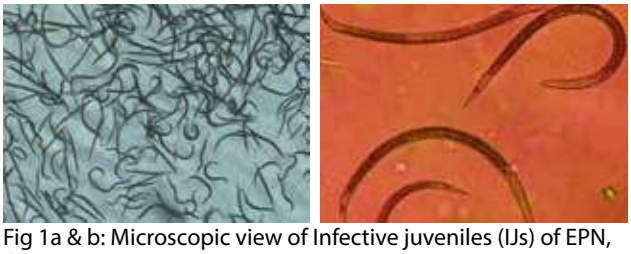


Fig 1a & b: Microscopic view of Infective juveniles (IJs) of EPN, S. carpocapsae

G. mellonella rearing on artificial diet

Extracting IJs from infected host insect

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Fig 4a: Healthy root grub

Fig 4b: EPN infected root grub

Fig 5: Kalpa EPN liquid formulation

heterorhabditid under laboratory conditions as they are highly susceptible to most of the EPN species and produces highest number of infective juveniles per unit body weight (Fig 3). They can be easily reared on artificial diet consisting of wheat & maize flour, rice bran, honey, yeast powder and milk powder in large numbers (Fig 2).

Utilization of EPNs in palm pest management

During 2014, ICAR - Central Plantation Crops Research Institute (CPCRI), Kasaragod developed an aqua formulation with virulent native isolates of EPNs, *Steinernema carpocapsae* {Kalpa EPN (CPCRI - SC1) for the management of white grub and other insect pests in the palm based cropping ecosystem. White grub or root grub, *Leucopholis coneophora Burm,* is a univoltine pest of coconut, arecanut and intercrops grown in sandy loam soils especially in southern states of India. Grub damages seedlings and adult palms by feeding on the roots affecting the water and nutrient uptake, which leads to death of the seedlings and yellowing of the fronds and complete yield loss in adult palms (Fig. 4a & b). Since the grubs are subterranean, their management have always been a difficult task. Since 2014, the efficacy of these EPN strains were widely demonstrated at farmers gardens across Kerala and Karnataka In collaboration with DASD sponsored project on Demonstration of EPN in arecanut for the management of root grubs, ICAR - KVK, Kasaragod and ICAR - All India Coordinated Research Project (AICRP) on Palms. Due to its efficacy, the root grub population was significantly reduced in the treated plot by 80 % following three year treatment period. This formulation can be used for the management of root grub in coconut and leaf eating caterpillars (Tobacco caterpillar, leaf rollers in

Fig 6a: EPN infected Galleria Cadaver b. Ready to transport cadaver formulation

Okra, cabbage, Diamond back moth on cauliflower etc.,) in the associated intercrops grown in palm cropping system. Attempts were also made and could successfully manage the infestation of red pumpkin beetle in cucurbits and pseudostem weevil in banana with EPN technology.

For the management of white grubs in arecanut/ coconut, drench the palm basin with 500 ml of EPN solution by mixing Kalpa EPN aqua formulation @ 150 ml in 10 liters of water during June - July and September – October (Fig.5). Similarly, foliar spray of EPN solution can taken up by mixing Kalpa EPN aqua formulation @ 150 ml in 15 liters of water for the management of leaf eating caterpillars in vegetables. Currently, ICAR - Central Plantation Crops Research Institute (CPCRI), Kasaragod is involved in distributing EPNs to the farmers on need basis. The cost of the 'Kalpa EPN aqua formulation" is fixed at Rs. 100 / 150 ml packet having 3 months shelf life and cadaver formulation @ Rs.5 / EPN infected *Galleria cadaver* (Fig.6 a & b). ■

Online Payment System for Coconut Journal Subscription

Coconut Development Board has introduced the online payment system for subscription for Coconut Journals. Both the new subscribers as well as the existing subscribers can make the payment and start or renew their subscription through the online mode.

For more details visit *www.coconutboard.gov.in*. or *https://www.coconutboard.in/journalsubscription/home.aspx*. The payment can be remitted through Board's Account: State Bank of India, Iyyattil Jn., Ernakulam Branch: Account No.- 61124170321,IFSC: SBIN0031449 through Demand Draft/ NEFT / BHIM / Phone Pe /Google Pay or PayTm.

Subscription payable (inclusive of Tax):		
	Annual Subscription	Life time subscription*
Individual Subscribers		
Indian Nalikera Journal	Rs. 40/-	Rs. 1000/-
Indian Coconut Journal	Rs. 60/-	Rs. 1600/-
Bharatiya Nariyal patrika**	Rs. 40/-	Rs. 1000/-
Institutes/ Libraries		
Indian Nalikera Journal	Rs. 200/-	Rs. 5000/-
Indian Coconut Journal	Rs. 200/-	Rs. 5000/-
** 30 years., **Quarterly*		

Farmers Field Day Training programme

Coconut Development Board, State Centre, Thane organized field day farmers training programme in association with Krishi Vigyan Kendra, Lanja on 2nd March 2021 at Krishi Vigyan Kendra, Lanja, Ratnagiri. The Training Programme was inaugurated by Dr.Anand Hanmante, Programme Co ordinator, KVK, Lanja in the presence of Dr.Sandeep S Patil,SMS, Extension, Prof. Sudeshk Urnar S Chavan, SMS, Plant Protection, Prof. Mahesh Mahal. SMS, Agronorny, Shri.Sharad S Aglawe, Field Officer, CDB, State Centre, Thane and Shri. V.V. Salvi, Programme Assistant.

Dr. Anand Hanmante, Programme Co ordinator, KVK, Lanja welcomed the gathering and spoke on activities of KVK in Ratnagiri, Prof. Mahesh Mahale,SMS, Agronomy briefed on Scientific Coconut Cultivation Technology and Prof. Sudeshkurnar S Chavan, SMS, Plant Protection, delivered a lecture on Pest and Disease Management of Coconut in Maharashtra

Shri.Sharad S. Aglawe, Field Officer, CDB State

Centre, Thane spoke on the Coconut Development Board scheme and activities for promoting scientific coconut farming and processing and value addition in coconut and marketing of coconut products in the State of Maharashtra.

Cultivation practices for coconut -May

Summer ploughing

Ploughing of interspace of coconut gardens can be taken up depending up on the receipt of summer showers.

Sowing of green manure seeds

• Wherever sufficient pre monsoon showers are received sowing of green manure seeds can be taken up towards the fag end of May. Sowing of green manure crops like Sunhemp (*Crotalaria juncea*) or Daincha (*Sesbania aculeate*) or Cow pea (*Vigna unguiculata*) or Wild Indigo (*Tephrosia purpurea*) can be done. In the interspace of coconut gardens under monocropping the following seed rate of green manure seeds is recommended.

Sunhemp – 20 kg/ha

Daincha – 30 kg/ha

Cow pea -25 kg/ha

Wild Indigo – 15 kg/ha

If intercrops are grown, seeds of green manure crops can be sown in the coconut basin of 1.8 m radius. For Cow pea and Daincha seed rate per basin is 100g while for other green manure crops 75 g seeds can be sown per basin.

Nursery management

Continue irrigation for the seedlings in the nursery until rains set in to provide sufficient moisture. Similarly, if rainfall is not received spray water on the lower surface of leaves of seedlings against spiralling white fly attack. Weeding has to be done wherever necessary. Land preparation is to be done for raising nursery beds.

Making pits for planting

Wherever new planting or gap filling of coconut seedlings are proposed dig pits of size 1m x 1m x 1m for planting. In laterite soils common salt can be applied to the pit @ 2 kg per pit for facilitating proper weathering of the soil. In such areas the pit size can be 1.2 m x 1.2 m x 1.2 m. Two layer of coconut husks can be spread at the bottom of the pit with concave surface up before filling the pit with soil up to 50 -60 cm for moisture conservation.

Generally the recommended spacing is 7.5 m x 7.5 m. However, wherever inter/mixed cropping is to be taken up coconut seedlings are to be planted at a wider spacing of 8-10 m.

Application of fertilizers

If pre monsoon showers combined with early onset of south west monsoon is experienced one third of the recommended dose of chemical fertilizers can be applied to the coconut palms under rainfed situation in the last week of May. Application of 500 g N, 320 g P_2O_5 and 1200 g K_2O

per palm per year is generally recommended for adult plantations. To supply one-third of the above nutrients it is necessary to apply about 0.36 kg urea, 0.5 kg rock phosphate (in acidic soil) or 0.7 kg Super Phosphate (in other soils) and 0.7 kg of Muriate of potash (MOP). After the receipt of summer showers, one-third of the recommended dose of fertilizers may be spread around the palms within the radius of 1.8 m and forked in. It is always advisable to test soil in the coconut garden periodically (once in 3 years) based on the results of which, type and dosage of chemical fertilizers can be decided.

Application of soil amendments

In soils with acidic nature (pH < 7), in addition to the recommended level of fertilizers, 1 kg of dolomite or 1 kg of lime may be applied per palm per year and gypsum can be applied in alkaline soils (pH >8.5) @ 1 kg per palm. Lime/dolomite/gypsum may be broadcasted during April - May in the coconut basins of 1.8 m radius and incorporated into the soil by forking. These soil amendments should be applied at least 15 days before the application of chemical fertilizers.

Irrigation

Irrigation has to be continued in coconut gardens until sufficient pre monsoon showers are received.

Pest and disease management

The month of May initiates with dry phase and during the latter phase the South-West monsoon could set in South India. Dryness of summer is so acute during 2019 and therefore sporadic outbreaks of invasive whiteflies and coconut eriophyid mites could be observed in several regions. Coconut palm not only needs water for its survival but also fills in nut water for quenching thirst for millions of mankind. Any moisture deficit situation could drastically affect the health status of palms as well and could aggravate problems due to pest invasion. The transition to wet period is very crucial for prophylactic treatment of crown cleaning, leaf axil filling with neem cake plus sand as well as application of 1% Bordeaux mixture. If timely prophylactic measures are attended, upsurge of monsoon pests and diseases could be effectively tackled. This period thus marks the beginning of all prophylactic treatments and the age-old practices still turn appropriate and relevant in the changing climate condition. Summer period could dominate with invasive whiteflies and this could significantly be suppressed in the monsoon time. The key pests and diseases of monsoon period would be discussed hereunder.

Leaf and inflorescence damage

Rhinoceros beetle (*Oryctes rhinoceros*)

Being a ubiquitous pest, the incidence of rhinoceros beetle is quite common during all period. However its damage is well felt during the planting season of coconut. Furthermore, coconut seedlings planted during May-June should be customarily shielded from pest incursion during this period. More than 0.5% natural incidence of Oryctes rhinoceros nudivirus (OrNV) was recorded in Peninsular India and therefore the OrNV-insensitive Coconut Rhinoceros Beetle-Guam (CRB-G) strain is not prevalent in our country, as this strain is taking a great toll in South-East Asian region causing great concern among International community making extensive damage. The pest invading juvenile palms and nuts is of greater concern these days. Moreover, the attack by rhinoceros beetle would invariable incite egg laying by red palm weevil as well as entry of bud rot pathogen

▶ *Management*

- Prophylactic treatment of top most three leaf axils with either botanical cake [Neem cake/marotti cake/pongamia cake (250 g)] admixed with equal volume of sand or placement of 12 g naphthalene balls covered with sand.

Shielding by fish net

- Routine palm scrutiny during morning hours along with brushing of teeth and hooking out the beetle from the infested site reduces the floating pest population. This strategy could reduce the pest population significantly.
- Shielding the spear leaf area of juvenile palms with fish net could effectively entangle alighting rhinoceros beetles and placement of perforated sachets containing 3 g chlorantraniliprole /fipronil on top most three leaf axils evade pest incursion.
- Dairy farmers could treat the manure pits with green muscardine fungus, Metarhizium anisopliae @ 5 x 1011 / m3 to induce epizootics on the developing grubs of rhinoceros beetle. Area-wide farmer-participatory approach in technology adoption could reduce the pest incidence very effectively and forms an eco-friendly approach in pest suppression.

Metarhizium infected grub

- Incorporation of the weed plant, Clerodendron infortunatum in to the breeding pits caused hormonal irregularities resulting in morphogenetic transformational aberration in the immature stages of the pest.
- Crop diversity induced by intercropping and ecological engineering principles would disorient pests and provide continuous income and employment as well.

Red palm weevil (*Rhynchophorus ferrugineus*)

Reduction in the incidences of rhinoceros beetle, would subsequently suppress the invasive potential of the killer pest, viz., the red palm weevil, which needs an injury for the weevils to orient towards the palm cue and lay eggs. Dwarf genotypes and palms aged between 5-15 years are relatively more susceptible. All life stages of the pest were noticed inside the infested palms. Being a fatal enemy of palms, 1% action threshold has been fixed. Correct geometry is very crucial for accommodating intercrops as well as pest avoidance due to multiple odour cues.

Adult weevils

▶ *Management*

- Field sanitation is very critical and all residual population in crown toppled palms should be destroyed
- Avoiding palm injury is very critical to disorient the gravid weevils away from the field and therefore leave out at least one metre from palm trunk when petioles are cut.
- Crop geometry and correct spacing is very crucial to reduce pest attack.
- Timely and targeted spot application of imidacloprid 0.002% (1 ml per litre of water) or indoxocarb 0.04% (2.5 ml per litre of water) on infested palms would kill the feeding grubs and induces recovery of palms by putting forth new spear leaf.

Toppling of palm

Crown entry

- Crop-habitat diversification (Ecological Bio-engineering) through coconut based cropping system strategy inciting defenders and pollinators would diffuse the palm-linked volatile cues and encouraged pest suppression. Diversified cropping system reduces pest incidence than mono-cropping.

Leaf rot disease (*Colletotrichum gloeosporioides, Exserohilum rostratum*)

It is commonly observed on palms affected by root (wilt) disease wherein foliar necrosis of terminal spear leaf and adjacent leaves are registered. The disease is prominently noticed in the post-monsoon phase during the month of December. Affected leaves turn necrotic and are not detachable from the palm and remain intact. This disease could be initially

Leaf rot disease in juvenile palm

Bud rot affected palm

observed as minute lesions which later enlarge, coalesce and cause extensive rotting affecting the photosynthetic efficiency of palms. The disease is endemic to root (wilt) affected regions of Southern Kerala.

▶ *Management*

- Need based pruning and destruction of disease affected regions of spear leaf and other adjacent leaves in the terminal region
- Spot application of hexaconazole 5 EC 2 ml in 300 ml water on the affected spear leaf region

Bud rot or immature nut fall (*Phytophthora palmivora*)

In certain humid locations bud rot occurred regularly killing hundreds of trees. In India, bud rot incidence is recorded as less than one per cent. Pathogen attacks the bud region leading to rotting of bud and death of palms. The first visible symptom is withering of the spindle marked by pale colour. The spear leaf or spindle turns brown and bends down. The affected spear leaf can easily be pulled out as the basal portion of the spindle is completely rotten emitting a foul smell. Temperature range of 20- 24ºC and relative humidity of 98% - 100% were found optimum for the development of the bud rot disease. Contiguous occurrence of such "favourable days" during rainy seasons determines the development of the disease and the intensity of infection. As Phytophthora diseases are known to be extremely fatal, a close scrutiny is mandatory during monsoon period to assess the health of the palm especially the spear leaf zone.

Withering of spear leaf

▶ *Management*

- Regular cleaning of the crown and prophylactic spraying of Bordeaux mixture (1%) to the crown just before the onset of monsoon and one more spray after 35-40 days help in reducing the bud rot incidence.
- Placement of two Trichoderma (Trichoderma harzianum CPTD28 isolate) enriched coir pith cakes in the inner most leaf axils just before the onset of monsoon and again after every two months.
- Remove the entire rotten portion of the spindle by cutting with a sharp knife and apply 10% Bordeaux paste to the wound and cover with polythene sheet to prevent entry of rain water. The protective covering has to be retained till normal shoot emerges.

Timely prophylactic application would equip palms to withstand the pressure of pest and diseases during monsoon period. As the adage says 'Prevention is better than cure" so should be our approach to avoid invasion by pest and diseases rather than seeking strategies for curing. ■

(Prepared by: Thamban, C. and Subramanian, P., ICAR-CPCRI Kasaragod and Joseph Rajkumar ICAR-CPCRI Regional Station, Kayamkulam)

Market Review – March 2021

Domestic Price

Coconut Oil

During the month of March 2021 the price of coconut oil opened at Rs. 21300 per quintal at Kochi and Rs. 21550 per quintal at Alappuzha market and Rs. 22000 per quintal at Kozhikode market. The price of coconut oil at Kochi and Alappuzha market expressed a downward trend during the month.

The price of coconut oil closed at Rs. 20950 per quintal at Kochi and Rs. 21000 per quintal at Alappuzha market and Rs. 22000 per quintal at Kozhikode market with a net loss of Rs. 350 for quintal at Kochi and Rs. 550 for quintal at Alappuzha market.

The prices of coconut oil at Kangayam market in Tamilnadu, which opened at Rs. 18867 per quintal and expressed an upward trend during the month and closed at Rs. 19133 with a net gain of Rs. 266 per quintal.

Weekly price of coconut oil at major markets Rs/Quintal)				
	Kochi	Alappuzha	Kozhikode	Kangayam
01.03.2021	21300	21550	22000	18867
06.03.2021	20850	20900	21900	18667
13.03.2021	20850	20850	21700	19000
20.032021	21150	21150	21900	19000
27.03.2021	21100	21250	22000	19000
31.03.2021	20950	21000	22000	19133

Milling copra

During the month, the price of milling copra opened at Rs.14050 per quintal at Kochi and Rs.13950 per quintal at Alappuzha market and Rs. 13950 per quintal at Kozhikode market.

The prices of milling copra closed at Rs. 13800 per quintal at Kochi and Rs. 13700 per quintal at Alappuzha market and Rs. 13650 per quintal at Kozhikode market with a net loss of Rs.250 at Kochi and Rs.250 at Alappuzha and Rs.300 per quintal at Kozhikode market.

At Kangayam market in Tamilnadu, the prices opened at Rs. 12700 per quintal and expressed a mixed trend and closed at the same price.

Weekly price of Milling Copra at major markets (Rs/Quintal)				
	Kochi	Alappuzha (Rasi Copra)	Kozhikode	Kan-gayam
01.03.2021	14050	13950	13950	12700
06.03.2021	13750	13700	13750	12500
13.03.2021	13750	13650	13650	12800
20.032021	13950	13800	13800	13000
27.03.2021	13900	13750	13800	12700
31.03.2021	13800	13700	13650	12700

Edible copra

During the month under report the price of Rajpur copra at Kozhikode market opened at Rs. 17000 and closed at Rs.16400 per quintal with a net loss of Rs.600 per quintal.

Weekly price of edible copra at Kozhikode market (Rs/Quintal)	
01.03.2021	17000
06.03.2021	17100
13.03.2021	17000
20.032021	16800
27.03.2021	15800
31.03.2021	16400

Ball copra

The price of ball copra at Tiptur market opened at Rs. 15200 per quintal and closed at Rs.14800 per quintal with a net loss of Rs.400 per quintal.

Weekly price of Ball copra at major markets in Karnataka (Rs/Quintal)	
01.03.2021	15200
06.03.2021	16000
13.03.2021	15500
20.032021	14900
27.03.2021	14000
31.03.2021	14800

**NR-Not reported*

Dry coconut

At Kozhikode market, the price of dry coconut opened at Rs.11750 and closed at Rs.11250 per quintal with a net loss of Rs.500 per quintal.

Weekly price of Dry Coconut at Kozhikode market (Rs/Quintal)	
01.03.2021	11750
06.03.2021	11750
13.03.2021	11650
20.032021	11450
27.03.2021	11250
31.03.2021	11250

Coconut

At Nedumangad market in Kerala, the price of coconut opened and closed at Rs. 20000 per thousand nuts during the month.

At Pollachi market, the price of coconut opened at Rs.17000 per thousand nuts and closed at Rs. 16000 per thousand nuts with a net loss of Rs. 1000 per thousand nuts.

At Bangalore market in Karnataka, the price of coconut opened and closed at Rs. 22500 per thousand nuts during the month.

Weekly price of coconut at major markets (Rs /1000 coconuts)				
	Nedumangad	Pollachi	Man-glore	Banglore
01.03.2021	20000	17000	22500	22500
06.03.2021	20000	17000	22500	NR
13.03.2021	20000	17000	22500	NR
20.032021	20000	16000	22500	27500
27.03.2021	20000	16000	22500	NR
31.03.2021	20000	16000	22500	25000

International price

Coconut

The price of coconut quoted at different domestic markets in Philippines, Indonesia, Srilanka and India are given below.

Weekly price of dehusked coconut with water				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India*
06.03.2021	248	215	NR	509
13.03.2021	249	229	NR	502
20.03.2021	248	230	NR	496
27.03.2021	250	229	NR	482
*Pollachi market				

Coconut Oil

International price of coconut oil expressed a downward trend during the month. However domestic price of Indonesia and India expressed an upward trend during the month.

The price of coconut oil quoted at different international/ domestic markets are given below.

Weekly price of coconut oil in major coconut oil producing countries					
	International Price(US$/MT)	Domestic Price(US$/MT)			
	Philippines/ Indonesia (CIF Europe)	Philip-pines	Indo-nesia	Sri lanka	India*
06.03.2021	1541	NR	1374	2680	2500
13.03.2021	1600	NR	1398	2520	2545
20.03.2021	1552	NR	1373	2471	2545
27.03.2021	1474	NR	1378	NR	2545
* Kangayam					

Copra

The price of copra at Philippines and Indonesia expressed a mixed trend during the month. The price of copra quoted at different domestic markets in Philippines, Indonesia, Srilanka and India are given below.

Weekly International price of copra in major copra producing countries				
Date	Domestic Price (US$/MT)			
	Philippines	Indonesia	Srilanka	India* * Kangayam
06.03.2021	917	841	1526	1674
13.03.2021	947	869	1491	1715
20.03.2021	939	853	1511	1741
27.03.2021	932	851	NR	1701

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